THE DESCRIPTION

Of a NEW-CONSTRUCTED

Double Microſcope:

In which

Some Uſeful IMPROVEMENTS are introduced:

As Made and Sold by the INVENTOR,

JOHN CUFF,

Over-againſt *Serjeant's-Inn* Gate, in *Fleet-ſtreet*, LONDON.

THE *Double Reflecting Microſcope* is an Inſtrument, which Gentlemen moſt converſant in microſcopical Obſervations, and the beſt Judges of Microſcopes, have been pleaſed to ſet the higheſt Value on: for its ſingular Excellence, in ſhewing a larger Area or Portion of an Object, than a ſingle Lens can do with the ſame Degree of magnifying; for the agreeable Diſtance from the Eye, at which an Object is ſeen through it; and for its being more capable of examining every

Kind of Object than any other Instrument besides. Another strong Circumstance in its Favour likewise is, that People unused to look through Glasses see Objects by it much more readily, and are always infinitely better satisfied, than when any other Microscope is employ'd.

But this Instrument, as hitherto composed, has not been without some Inconveniencies, tho' the Structure of it has been varied several Ways. The Contrivances, many Years ago, of Dr *Hooke*, Mr *Marshall*, and Others, for applying two or three Glasses to increase the magnifying Power, were so cumbersome in themselves, and difficult in their Use, that few People had Patience to employ them. In These to get a Light was particularly troublesome: The only Way of attaining it, in some, being by placing a Candle underneath the Table they stood on, and transmitting its Light through a Hole; and, in others, by throwing Light upon the Object, either from a Candle, or the Sun, through a Vessel of Water, or a convex Glass, on one Side thereof.

Mr CULPEPPER and Mr SCARLET being sensible of these Difficulties, contrived, several Years ago, to throw up a good Light upon the Object from either the Sun, the Sky, or a Candle, by means of a Looking-Glass placed underneath; and composed what has ever since been called the *Double Reflecting Microscope*: An Instrument pretty in its Form, very easy in its Use, and generally and deservedly held in great Esteem.—— But as Perfection comes by slow Degrees, this Structure tho' infinitely better than any Thing known before, is subject to some Inconveniencies, as well as Deficiencies, which Gentlemen best skill'd in such Matters, have frequently been wishing to get remedied.—— In the first Place, the Method

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Method of bringing the Magnifiers nearer to, or farther from the Object to be view'd, by the ſliding of one Tube within another, muſt of Neceſſity be made by little Jerks, and conſequently ſo unequal and uncertain, that when Glaſſes magnifying much are apply'd, unleſs People have been long Practicers, they are unable to find the true Focus, and ſtop exactly at it; and even the moſt dextrous can ſeldom do it in a ſatisfactory Manner, without a good deal of Time and Difficulty. The two Tubes being made of Paſteboard and Vellum, are apt alſo to ſwell and move ſo hard in wet Weather, and on the contrary become ſo looſe, by their ſkrinking, when the Air is dry, that the Evil is greatly increaſed thereby. Another Fault frequently objected to this Inſtrument is, that its Apparatus for viewing opake Objects, by Means of a Side Light thrown upon them through a convex Lens, is not ſo good as might be wiſhed: It being in many Caſes very difficult to point a Light exactly upon the Object, and when it is ſo pointed ſeldom anſwering our Expectation.

And laſtly, Complaints are ſometimes made, that although the Stage for placing Objects before this Inſtrument is extremely commodious and ready on moſt Occaſions; yet, for ſome particular Examinations and Experiments, where Parts of large Bodies are required to be turn'd about and brought under the Magnifier, the Legs of the Microſcope are in the Way, to the great Inconveniency and Embaraſment of the Obſerver.

As it is greatly my Intereſt, as well as my moſt earneſt Deſire, to render all the Inſtruments I deal in as perfect in their Kinds as poſſible, I have continually, from Time to Time, been endeavouring to remedy theſe Inconveniencies.—In order to prevent the jerking and unequal Motions firſt men-

tion'd, I made ſome of theſe Microſcopes, which, by Virtue of a Screw at the Bottom of the Body Part, could adjuſt the Focus of the Magnifier very eaſily; but then, as the whole Body of the Inſtrument turned round in ſetting the Focus right, the Object would, ſometimes, be not found exactly in the Place required. This therefore leſſen'd the Inconveniency, but did not quite remove it.

I added likewiſe a concave Silver Speculum, to be applied to any of the Magnifiers, which anſwer'd very well; but the Legs I could not get rid of, nor was it poſſible, in that Form, to make the Whole fully anſwer the Deſires of the Curious.

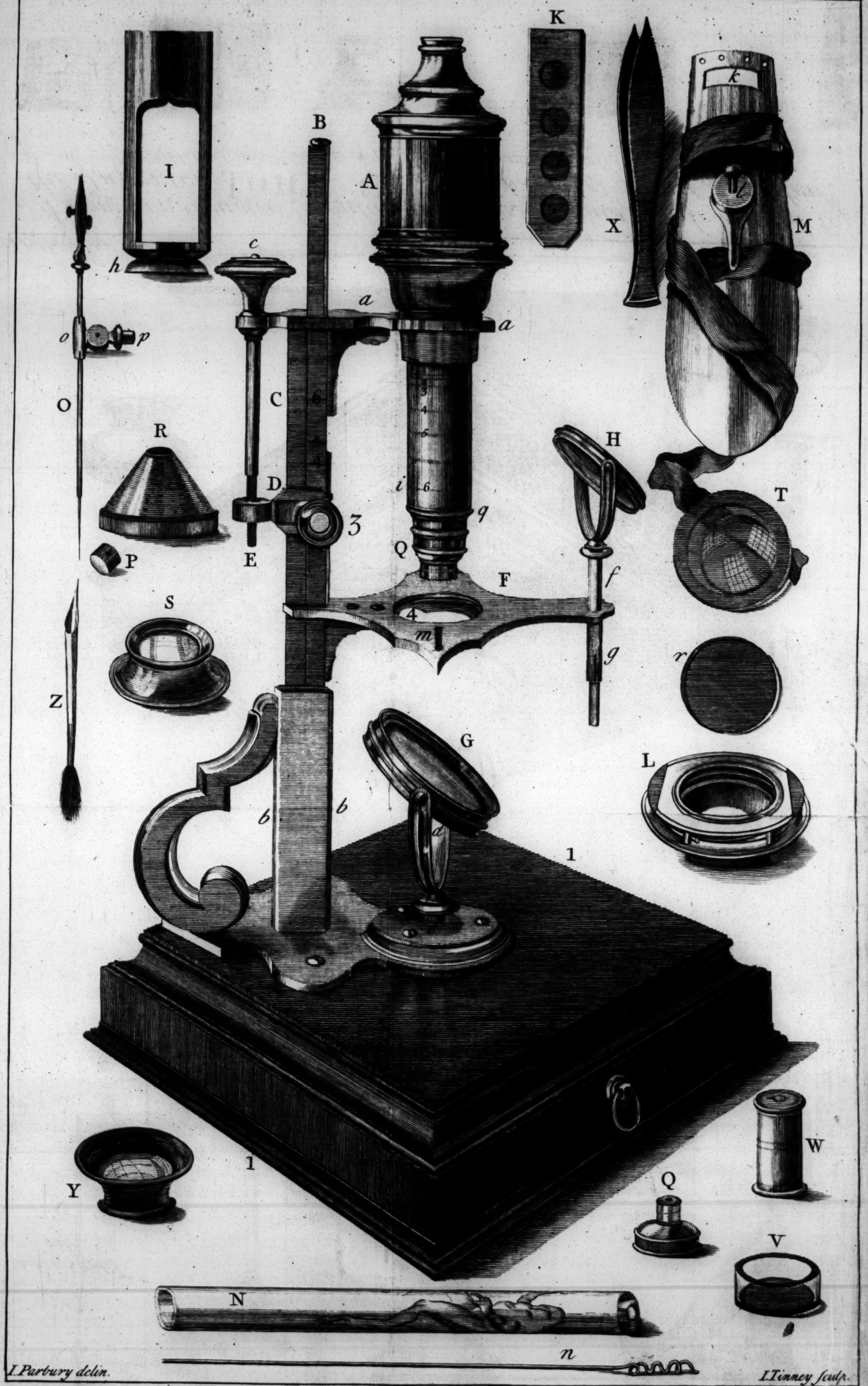
In order therefore to remove all Complaints at once, the preſent Microſcope is contrived, of a new Conſtruction, whoſe Motion is eaſy, regular and ſteady; whoſe Apparatus for opake and all other Objects will be found convenient; whoſe Stage is quite free for any Subject whatever to be apply'd on; and whoſe general Figure cannot, 'tis hoped, be thought unhandſome. But all this is humbly ſubmitted to the Opinion of the beſt Judges, on whoſe Favour I rely, and whoſe

Moſt obedient

Fleet-ſtreet,
Sept. 20*th*, 1744. *and moſt devoted Servant I am.*

JOHN CUFF.

A. Re-



A new constructed Double Microscope, as made & sold by the Inventor JOHN CUFF *in Fleet Street London.*

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A. Repreſents the Body of the Microſcope, made of Braſs (as moſt of the Parts are) and ſupported by an Arm *aa*, having a broad circular Collar at its End, whereinto the ſaid Body becomes fixt, or from whence it can be taken without any Kind of Difficulty.

This Arm is faſten'd to, and proceeds from the Top of the ſliding Pillar C.

B. A long, flat-ſquare, upright Pillar, erected on, and firmly ſcrew'd down to the wooden Pedeſtal 1 1, by Means of a ſquare long Box *bb*, which ſupports the whole Machine.

A Drawer 2, within this Pedeſtal, contains all the looſe Parts of the Apparatus.

C. Another Pillar, of the ſame Shape and Size exactly as the Pillar B, but ſhorter. This moves up or down with the Body of the Microſcope, as Occaſion requires, in the long ſquare Box *bb*, with its broad flat Side ſliding cloſe *againſt*, and parallel *to* the like broad flat Side of the ſaid Pillar B.

Theſe two Pillars make up together almoſt a regular long Square, as they ſtand in the Box *bb*, which is contrived purpoſely for their Reception.

The moveable Pillar C, can be raiſed to the Top of the Pillar that is fixt B; but is ſtopped there, as parting them would be needleſs.

D. A ſquare Collar, girding the two Pillars, B and C, and ſliding up and down over them. On one Side it is furniſh'd with a Screw-Button 3, to faſten it to the Pillar B, and prevent the Pillar C from ſlipping, when the Diſtance of the Microſcope is ſet nearly right, by Means of the ſix Figures on the Pillar B, correſpondent to the ſame Numbers on the ſix Magnifiers.

E. A fine-threaded adjuſting Screw, which (when the Collar D is faſten'd) by only turning the Button

Button *c* to the Right or Left, moves the Microſcope nearer to or farther from the Object, ſo gently, ſteadily, and by ſuch inſenſible Degrees, that the *true Focus* may be found readily, and the Inſtrument made faſt, without any Jerks or Slips, and with the utmoſt Exactneſs and Certainty.

F. A flat horizontal Plate, faſten'd to the Pillar B, with a circular Hole 4 in the Center thereof, over which the Body of the Microſcope is ſuſpended in a perpendicular Line.

This is the Stage whereon to lay all Sorts of Objects for Examination; and it will be found much more convenient than the ſame Part in the common *Double Microſcope*, where the Legs are frequently in our Way.

G. Is a concave Looking-Glaſs, ſet in a Box of Braſs, and turning in an Arch *d*, upon two ſmall Screws. From the Bottom of the Arch comes a Pin, which by letting down into a Hole *e* in the Center of the Pedeſtal, enables it to turn vertically, or horizontally, and reflect the Light, either of a Candle or the Sky, directly upwards on the Object to be examined.

H. A double convex Lens, which turning on two Screws, tranſmits Light to aſſiſt in illuminating opake Objects, when the long cylindrical Part *f* is placed in the Spring Tube *g* faſten'd to one Corner of the Stage F.

I. Is a tubular hollow Cylinder with its Sides open'd, to the End whereof is ſcrew'd a concave Silver Speculum *h*, having a round Hole in the Middle of it. This Cylinder ſliding over the Snout of the Microſcope *i*, and ſet properly to the Magnifier made Uſe of, (by the directing Figures mark'd on the ſaid Snout, as will by and by be taught) a direct Light becomes reflected from

from the *Silver Speculum* on any opake Object under Examination.

K. A flat Piece of Ivory, call'd a Slider, with four round Holes through it. Eight Sliders belong to this Microſcope, ſix whereof are fill'd with Objects confin'd between Tales or Iſinglaſs by Braſs Rings of Wire. But the Curious may have what Number they pleaſe to make Collections for themſelves.

L. A Contrivance to place the Sliders in, and keep them ſteady for Obſervation, which may be called a *Slider-Holder*. It conſiſts of a ſpiral Steel Wire confined between three flat Circles, one whereof is moveable for the Admiſſion of the Sliders. The Shank underneath fits the round Hole 4, in the Center of the Stage F, where it muſt be put when uſed.

M. A Braſs Fiſh-pan, whereby to faſten a Smelt, Gudgeon, or other ſmall Fiſh, in order to ſee the Blood circulate in its Tail. For this Purpoſe the Tail of the Fiſh muſt be ſpread acroſs the oblong Hole *k*, at the ſmalleſt End of the Pan: then by ſlipping the Button *l* into the ſlit *m*, through one Corner of the Stage F, the Spring at Bottom of the Stage will make it ſteady, and preſent it well to View. If the Fiſh is unquiet, the four little Holes at the End are intended for Threads, or little Pegs of Wood, to aſſiſt the Ribband at the Side in bracing it down tight, and prevent its being able to ſtruggle.

N. A Glaſs Tube, which is more convenient than the Fiſh-pan for viewing the Circulation in a Frog, Newt, or Eel. The Tail of a Newt or Eel, or, in a Frog, the Web between the Toes of the hind Feet, are the Parts where it may be ſeen beſt, as being the moſt tranſparent.

When

When the Object is well expanded on the Inſide of the Tube, ſlide the Tube along under the Hole 4, in the Center of the Stage F, (where there are two Springs and a Cavity made in the Shank to hold it) and bring your Object directly under the Magnifier. A Frog is repreſented in the Glaſs Tube before us, to ſhew the Poſture it ſhould lie in.

There are four or five of theſe Glaſs Tubes, ſmaller one than another; and the Size of the Object muſt direct People which to uſe: but, in general, the leſs Room the Creature has to move about in, the eaſier it may be managed, and the quieter it will lie to be examined.

n. A long Wire with a Worm at one End, to pull out the Cotton kept in the Tubes, and prevent their breaking one another; and likewiſe to clean the Tubes when foul, by winding ſome Cotton round the Worm, and rubbing it about within them.

O. A long ſtrait Wire, with a Pair of Spring Tongs at one End, and at the other a ſharp Point, to hold faſt or ſtick Objects on. This Wire ſlips backwards or forwards in a Spring Tube *o*, faſten'd to a Joint with a ſhort Shank *p*, that fits into a round Hole of the Slit *m*, upon the Stage F.

P. A little Block of Ivory, white at one End, and black at the other, for Objects to be placed on according to their Colour; with a Hole through which to ſtick it on the Point of the Steel Wire O. On this Block, Sands, Salts, or other little Bodies are to be laid, in order to be view'd by the reflected Light of the Silver Speculum *b*; and it is made thus ſmall, that it may obſtruct as little as poſſible the Rays thrown up from the Looking-

ing-Glaſs G. By this Contrivance opake Objects are ſeen to great Advantage.

Q and Q. Two ſmall Cells, wherein the Magnifying-Glaſſes are ſet; and therefore uſually call'd *Magnifiers*. Six of theſe, with Glaſſes of as many different Powers, in the moſt convenient Gradation, belong to this Microſcope; and ſcrew on, when made Uſe of, to the Bottom of the Snout at *q*, after the Manner one of them now appears, as ſcrew'd on for Service.

R. A Braſs Cone to faſten on the Shank underneath the Middle of the Stage F, principally when the firſt, ſecond, or third Magnifiers are employ'd, to look at Objects that are very tranſparent: for Experience teaches that ſuch Objects are rendered much more diſtinctly viſible, by intercepting ſome part of the oblique Rays reflected from the Concave Looking Glaſs. Such cutting off the Rays is alſo advantageous in viewing the Circulation of the Blood; but the Glaſs Tubes and this Cone cannot be made uſe of at the ſame Time: inſtead therefore of the Cone, here are two or three thin Paſtboards, with different Appertures, to lay over the Looking Glaſs, and prevent any Rays from being reflected, excepting from its Middle.

A little Experience will ſhew the Neceſſity of ſuiting our Light to the Object, and the Glaſs we uſe to view it. In ſome Caſes 'tis impoſſible to have too much: at other Times, when the Object has little or no Colour, a few Rays are ſufficient, and the Out-lines can ſcarce be ſeen, unleſs the Light comes from a Point only.

A due Attention to this will always obtain a ſatisfactory View of all Kinds of Objects: where-

as without it the beſt Glaſſes in the World may be imagin'd to be but very indifferent.

S. A round Cell or Box, to confine Fleas, Mites, Lice, or any other living Object between its Top and Bottom; one of which is a Concave, and the other a plain Glaſs.

At the Time of Examination this Cell is to be placed over the Hole 4, in the Middle of the Stage F; after having covered the ſaid Hole with the plain round Glaſs *r*. Then being mov'd about, the Object will ſoon be found.

T. A concave Glaſs, wherein to place a Drop of any Liquid, or other Object, occaſionally to be examined.

V. A Glaſs cylindrical ſhallow Veſſel, for holding a Tea-Spoonful of Water, to view the larger Kinds of Animalcules ſwiming backwards and forwards therein.

W. An Ivory double Box, with Covers ſcrewing on at each End, deſigned to contain a Number of Talcs, and Rings of Wire to faſten them in the Sliders.

X. A Pair of Forceps or Nippers, for taking up and adjuſting any Object to be examined.

Y. A Hand Magnifying Glaſs, extremely uſeful in preparing Objects for the Microſcope, and on many other neceſſary Occaſions.

Z. A ſoft Hair Bruſh to clean the Glaſſes, or take up a Drop of any Fluid for Examination. The Quill End ſerves to remove any dry Dirt adhering to them.

Having deſcribed all the Parts of this Microſcope and its Apparatus in ſo full a Manner, the Directions as to the Viewing of Objects by it will be very ſhort and eaſy.

If your Intention is to examine any Thing in a Slider,

Slider, thruſt your Slider between the flat Braſs Plates in the *Slider-Holder* L: which place in the round Hole 4, in the Middle of the Stage F; then ſcrew on whatever Magnifier you chuſe to employ, to the Snout of the Microſcope; and bring the upper Part of the ſquare Collar D, to that Figure mark'd on the Pillar B, which is correſpondent to the Number on the Magnifier you uſe. — Suppoſe, for Inſtance, your Magnifier is N° 5, you muſt then ſlide the upper Edge of the Collar D, either up or down, till it comes exactly to the Figure 5 on the Pillar B. Fix it there by a Turn of the Screw-Button 3, and having directed a good Light upon the Object from the Looking-Glaſs underneath, if the Object is not ſeen diſtinctly, gently move the Button *c*, at the Top of the adjuſting Screw E, one Way or the other, till, by obtaining the exact Focus, your Object is ſhewn ſharp, diſtinct, and perfect; and this you will do eaſily, without any Jerks in the Inſtrument, or any Danger of diſplacing the Object.

But if the Object you examine is apply'd on either End of the Steel Wire O, or in the Glaſs Tube N, (as the Tube is faſten'd underneath the Stage, and the Steel Wire ſtands not at the ſame Place as the Sliders do) the Figures on the Pillar B are not to be regarded; but the Body of the Microſcope muſt be moved up or down, till you come near the Focus, and then the adjuſting Screw will ſoon bring it exactly right.

If an opake Object is to be view'd, fit the little Ivory Block P on the End of the Steel Wire O, and if the Object be white, place it on the black; if black, on the white Side: then put the hollow Cylinder I, with the Silver Speculum *h*, over the Snout of the Microſcope; bring the Top of the Cylinder to the Figure mark'd on the ſaid Snout, which

which anſwers to the Number of the Magnifier you uſe, moving your Microſcope up or down till you ſee the Object tolerably clear: fix it by the Screw-Button 3, as before directed, and bring it exactly to the Focus by the adjuſting Screw.—The Object will be ſhewn by this Contrivance in a delightful Manner; for the Rays of Light thrown upwards from the Looking-Glaſs which paſs by the Sides of the Object, become reflected back upon it by the *Silver Speculum*, and ſo enlighten it, that its Colours, as well as Shape, are beautifully exhibited. When an Object is too large for this Speculum, the convex Glaſs H muſt be made Uſe of, to direct a Light upon it from a Candle or the Sun.

'Tis beſt to keep the adjuſting Screw about half Way through the ſquare Collar D, that there may always be ſufficient Room to turn it either Way as much as Need requires.

The two Glaſſes within the Body of the Microſcope ſhould be taken out ſometimes (by unſcrewing the Parts they lie in) and cleaned with due Care, breathing on them, and wiping them with ſoft Waſh-leather or Linnen Cloth. Dry them well before they are replaced, and be very cautious not to ſoil them with the Moiſture of your Fingers. If any dry Dirt ſticks on them, waſh it off with Spirits of Wine.

The Magnifying Glaſſes in the little Cells muſt likewiſe be made clean frequently with the Hair Bruſh; and if that is not ſufficient, take them out, breathe on them, and wipe them; for if any Powder, Duſt, or Soil adheres to the Glaſſes, no Object can be ſeen well.

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